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The title of the invention has been amended (Guidelines for Examination in the EPO, A-III, 7.3).

⑤ **Vehicle fleet fuel monitoring system.**

⑤ A data monitoring system for use in the operation of a fleet of commercial vehicles, comprising a fuel supply means comprising a fuel pump (30) connected to a fuel dispensing nozzle (22) by way of a flexible fuel delivery hose (28). A fuel management system (18) is coupled to the fuel pump (30) for controlling the amount of fuel dispensed via the nozzle (22). One end of a fibre optic (20) is carried by the pump nozzle (22) for receiving information from a radiation transmitter (14) on any of said commercial vehicles when the pump nozzle (22) is inserted into the fuel entry port (24) of that vehicle, the other end of the fibre optic being positioned to supply the information to the fuel management system (18). The fibre optic is run from the top of the nozzle (22), through a special fitting (26) into the interior of the hose (28), the fibre optic then running the length of the delivery hose, surrounded by the fuel product, until it reaches the region of the fuel pump (30), where it emerges from the hose via a gland (40) and runs on to the fuel management system (18).

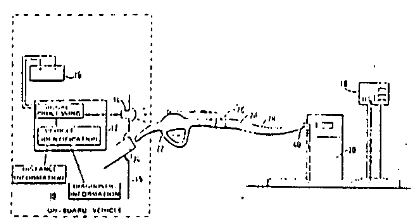

FIG.1

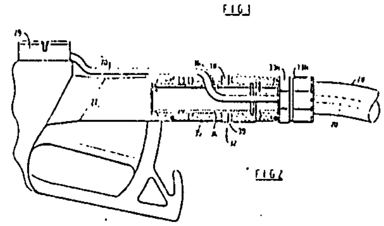

FIG.2

Description

FLEET DATA MONITORING SYSTEM.

The present invention is concerned with a system for monitoring data in connection with the operation of a fleet of commercial vehicles.

For efficient operation of a fleet of commercial vehicles it is important that details of fuel used, distance travelled and diagnostic information is available for each vehicle on a regular basis.

Most operators of large fleets of vehicles have on-site fuelling facilities. These require identification of a valid vehicle before fuelling can take place, and allow for entry of other details such as odometer information. Using traditional systems, this information relies on manual input from the fueller of the vehicle and could be incorrect.

It is also possible that other information is available in the form of on-board diagnostics. Using traditional techniques, this information has only been available by manually reading instruments in the cab or by plugging in a diagnostic facility at a service bay.

In one system which has already been proposed for monitoring the amount of fuel dispensed from a delivery conduit to a fuel tank in a vehicle (US 4 469 149), a data-providing means is arranged to be associated with the circumference of a tubular entry port leading to the vehicle fuel tank. The data-providing means supplies data relating to that tank and the associated vehicle. The delivery conduit has a nozzle which is adapted to be received into the tubular entry port for delivering fuel to the vehicle tank. The part of the nozzle which is introduced into the entry port carries a data reader which is adapted to read data from the data-carrying means when the nozzle is being inserted into the entry port.

The latter system has the disadvantage that the data-providing means is necessarily associated with the tank entry port itself. For example, it can be disposed wholly around the inner or outer circumference of the tubular entry port. As a result, the data reader has to be located on or in that part of the nozzle which is introduced into the entry port. It is therefore particularly susceptible to damage during the repeated introduction and removal of the nozzle.

In order to overcome this latter problem, it is also known for data to be transmitted from the vehicle to a detector on the nozzle end of a fuel delivery conduit by means of an infra-red signal generated by an infra-red emitter disposed near to but not directly associated with the fuel entry port itself. Thus, the infra-red emitter is disposed sufficiently close to the fuel entry port such that, when the nozzle is inserted into the entry port an infra-red detector on the nozzle lies automatically in a position in which it will pick up infra-red radiation transmitted by the infra-red emitter.

In the latter known system, the infrared detector has transmitted signals back to a fuel management system electronically, either by way of hard wiring or radio link.

Such known systems have, however, the disadvantage of allowing electrical signals to be present in close proximity to exposed fuel so that, even though these electrical signals are of very low level, the possibility of sparks and ignition of the fuel cannot be totally discounted.

It is also known (DE 3 438 939) to transmit information to a pump nozzle by passing a fibre optic along the length of the flexible fuel delivery conduit connecting the pump nozzle to the fuel pump. The signals received optically at the fuel nozzle are then converted into electrical signals at the nozzle to drive an electronic display on the nozzle for indicating to the user such information as fuel quantity delivered, price etc. This system therefore again involves the disadvantage that electrical signals are present in the region of fuel.

It is an object of the present invention to provide a system in which the presence of such electrical signals is removed altogether from the region of the pump nozzle.

In accordance with the present invention, the vehicle is arranged to transmit optical radiation which is picked up by a fibre-optic whose one end is carried by a pump nozzle, coupled to a fuel pump by way of a fuel delivery conduit, so as to be disposed in a position facing the transmitter when the pump nozzle is inserted into the fuel entry port of the vehicle, and which runs, by way of the fuel pump, to a remote fuel management system which interrogates the fibre optic and processes signals received therefrom, the fibre optic being arranged to be carried within the fuel delivery conduit itself in extending between the pump nozzle and the fuel pump.

Preferably the fibre optic is surrounded by a protective metal sleeve and extends into the fuel delivery conduit via a joint on the pump nozzle.

Advantageously, the metal sleeve in the exposed region of the fibre optic is stainless steel tubing. Where the fibre optic is disposed within the fuel delivery conduit, the metal sleeve can be of a flexible type, e.g. in the form of a flexible helix.

Before the delivery conduit reaches the associated fuel pump, it is necessary to provide a gland through which the fibre optic emerges before travelling on to the fuel management system.

In a preferred embodiment, the fibre optic is run from the top of the nozzle, through a custom designed fitting into the centre of the fuel delivery hose. The fibre optic then runs the length of the delivery hose, surrounded by the fuel product, until it reaches the region of the fuel pump, where it emerges via the gland.

An on-board unit on the vehicle is arranged to transmit a data stream via the optical transmitter (e.g. an L.E.D.) comprising items such as vehicle identity, odometer details, and diagnostic information. In some embodiments, the data stream can be provided continuously and repeatedly, so that it is passed automatically to the fuel management system upon the transmitter and fibre optic being brought into transmissive connection. The data is

arranged to be processed by the fuel management system and, if determined to be valid, the fuel pump is energised to allow fuel to be dispensed. Delivery of fuel is terminated as soon as transmissive contact between the transmitter and fibre optic is lost as a result of the fuel nozzle being withdrawn from the vehicle fuel tank.

The data received from the vehicle is processed in a conventional manner by the fuel management system, and can be available to the operator in the form of a fleet report, when requested.

In this manner, there is provided a data monitoring system wherein electrical signals in the region of the pump nozzle are avoided in an ergonomic and elegant but simple manner.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, wherein:-

Fig.1 is a highly diagrammatic representation of one embodiment of a fleet data monitoring system in accordance with the present invention;

Fig.2 is a longitudinal section through an adaptor member on the pump nozzle, showing the fibre optic passing therethrough; and

Fig.3 is a longitudinal section through a gland by which the fibre optic leaves the fuel hose.

On board each of a plurality of vehicles 10 is a data unit 12 which carries a unique vehicle identification which can be transmitted electronically to a transmitter unit in the form of an L.E.D. 14 mounted at a location at or adjacent the exterior of the vehicle body 15. Other information relating, for example, to distance travelled and diagnostic tests, can be supplied to the data unit 12 and hence, in the form of a coded signal, to the transmitter unit 14. The units 12 and 14 are normally powered by the vehicle battery system 16.

Distance information can, for example, be generated by a tachograph (not shown), or by measuring a rotation proportional to distance travelled, i.e. rotation of an odometer drive, drive shaft or road wheel.

Diagnostic information can be obtained from any of a number of sources, such as a plurality of simple on/ off alarm signals, oil temperature or pressure sensors, water temperature sensors, light failure sensors, worn disc pads, etc., or from a more sophisticated on-board diagnostic system.

The apparatus also includes a fuel management and/or security system 18 which would normally be located at a fixed location. Information transmitted optically by the L.E.D. 14 is arranged to be picked up by a fibre optic 20 and carried to the fuel management system 18. To achieve this, one end of the fibre optic 20 is mounted on the top of the fuel nozzle 22 so as to lie in a position facing the L.E.D. 14 when the nozzle has been correctly inserted into the fuel entry port 24 on the vehicle 10. The fibre optic 20 is contained within an outer stainless steel sheath and passes at 26 through a specially designed fitting into the centre of the fuel hose 28. The fibre optic 20 then runs the length of the hose 28, surrounded by the fuel product, until it reaches the region of the fuel pump 30. This arrangement provides protection and extra mechanical strength for the fibre optic compared to a situation in which the fibre optic were to be run externally of the hose. In the region of the fuel pump 30 the fibre optic passes out of the fuel hose again by way of a suitable gland 40 (see Fig.3) and then runs on to reach the fuel management system 18.

In the portion of the fibre optic extending through the flexible hose 28, the surrounding metal sheath can be made correspondingly flexible, for example by use of a helical-type sheathing.

Fig. 2 shows one example of an adaptor 32 which can be fitted between the usual nozzle device 22 and the flexible hose 28 to enable the fibre optic to enter the hose. The adaptor 32 is in the form of a metal tube 34, usually stainless steel, the left-hand end of which (as viewed in Fig .2) is adapted to be fitted to the conventional nozzle 22. The right-hand end of the adaptor receives a swivel device comprising non-rotating swivel components 33a,33b and a swivel adaptor 39 to which the hose 28 is screw fitted to enable some relative rotation of the pump nozzle and the hose. One end of the fibre optic terminates in a housing 29 fitted rigidly to the top of the nozzle body 22. The fibre-optic 20 passes into the interior of the adaptor 32 by way of an aperture 36 in the wall of the tube 34 and is welded to the wall of the tube 34 at this location (the weld is not shown in Fig.2). The region around the weld is covered by a protective sleeve 35 held in place by a locking ring 38.

Fig.3 shows the gland 40 in more detail. A metal sleeve connector element 42 is connected at its one end to the hose and at its other end to the fuel pump fixture 30. Disposed at an oblique angle to the longitudinal axis of the sleeve element 42 is a tubular metal ferrule holder 42 which is welded or brazed into a correspondingly angled aperture 44 in the holder wall. The outer end of the ferrule holder 42 carries a ferrule cap 46, O-ring top hat 48 and O-ring 46. In use, the ferrule holder 40 receives a ferrule (not shown) fixed on the fibre optic so as to enable the fibre optic to leave the hose in a fluid-tight manner.

Thus, by the aforegoing arrangement, the fibre optic is enabled to pass along the interior of the hose 28 and to emerge in a fluid-tight manner at the two ends of the hose adjacent the fuel pump 30 and fuel nozzle 22, respectively.

Thus, in use, the transmitter 14 on the vehicle is arranged to send coded signals to the management system by way of the fibre optic 20, the coded signals normally including the vehicle identity and the distance and diagnostic information. If the vehicle is determined by the management system to be valid (i.e. to be one to which fuel can be dispensed), the fuel pump 30 is energised and the nozzle is permitted to dispense fuel to the vehicle tank.

During the time that the vehicle is drawing fuel, the diagnostic information is transferred.

When the link between the transmitter 14 and fibre optic 20 is eventually broken by removal of the fuel nozzle from the tank for more than a predetermined timeout, the pump 30 is arranged to be switched off.

The management system 16 can then prepare a

transaction report with such items as the date, time, vehicle identity, amount and type of fuel odometer reading and any alarms that have been noted.

The management system 16 subsequently processes the transaction report and updates the vehicle record files. Any reportable items such as low mpg or vehicle alarms are extracted and reported to the fleet operator.

Although the abovedescribed embodiment is able to transmit only in one direction, i.e. from the vehicle to the fuel management system, other embodiments can be arranged to accommodate bi-directional transmissions both from the vehicle to the management system and vice versa. In this case, the infra-red transmitter is replaced by a transmitter/receiver device so that it can also receive light signals emitted from the pump nozzle end of the fibre optic 20.

Bidirectional transmission is useful in that, for example, the management system can be arranged to transmit a coded signal and it is only on receipt of this coded signal that the information is passed back to the management system regarding the vehicle data and fuel requirements, etc.

Thus, for example, upon receipt of the coded signal from the management system 18, the transceiver 14 on the vehicle may be arranged to send a further coded signal back to the management system, comprising the vehicle identity and the distance and diagnostic information. If the vehicle is determined by the management system to be valid (i.e. to be one to which fuel can be dispensed), the fuel pump is switched on and the nozzle is permitted to dispense fuel to the vehicle tank.

During the time that the vehicle is drawing fuel, the diagnostic information can be transferred. During the same period, any alarm indicators, real time clocks and the like, on the vehicle can be reset.

Claims

1. A data monitoring system for use in the operation of a fleet of commercial vehicles, comprising
a fuel supply means comprising a fuel pump means (30) connected to a fuel dispensing nozzle (22) by way of a flexible fuel delivery conduit (28);
a fuel management system (18) coupled to said fuel pump means (30) for controlling the amount of fuel dispensed via the nozzle (22), and
a sensor means carried by the nozzle (22) for receiving information from a radiation transmitter (14) on any of said commercial vehicles when the pump nozzle (22) is inserted into the fuel entry port (24) of that vehicle, whereby to transmit information concerning that vehicle to the fuel management system (18);
characterised in that the sensor comprises a fibre optic (20) whose one end is disposed on the pump nozzle (22) in a position to enable it to communicate optically with the radiation transmitter (14) when the pump nozzle is inserted into that fuel entry port, the radiation transmitter being disposed on said vehicle in a position external to said fuel entry port (24), the other end of the fibre optic (20) being positioned to supply information, received from the transmitter (14), to said fuel management system (18), which interrogates the fibre optic and processes signals received therefrom, and at least part of the length of the fibre optic (20) being carried within said flexible fuel delivery conduit (28) in extending between the pump nozzle (22) and the fuel pump (30).

2. A system as claimed in claim 1, wherein the fibre optic (20) is run from the top of the nozzle, through an adaptor (26) into the interior of the fuel delivery conduit (28), the fibre optic then running the length of the delivery conduit (28), surrounded by the fuel product, until it reaches the region of the fuel pump (30), where it emerges from the delivery conduit (28) via a gland means (40).

3. A system according to claim 2, wherein the fibre optic (20) is surrounded by a protective metal sleeve.

4. A system according to claim 3, wherein the metal sleeve in the exposed region of the fibre optic (20) before it enters the fuel delivery conduit (28) is stainless steel tubing.

5. A system according to claim 4, wherein the said metal sleeve on the part of the fibre optic disposed within the fuel delivery conduit (28) is itself flexible.

6. A system as claimed in claim 3, 4 or 5, wherein the adaptor (26) comprises a metal tube (34), one end of which is fitted to the nozzle (22) and the other end of which is coupled to the flexible fuel delivery conduit (28) by way of a swivel device (33,39), the fibre optic (20) passing into the interior of the adaptor (32) by way of an aperture (36) in the wall of the tube (34), the metal sleeve which surrounds the fibre optic being welded to the tube (34) where it passes through the aperture (36).

7. A system as claimed in claim 6, wherein the region around the weld is covered by a protective sleeve (35) held in place around the metal tube (34) by means of a locking ring (38).

8. A system as claimed in any of claims 1 to 7, wherein the vehicle also includes a radiation receiver and wherein the sensor is adapted to enable two-way communication with the vehicle by means of said radiation transmitter and receiver.

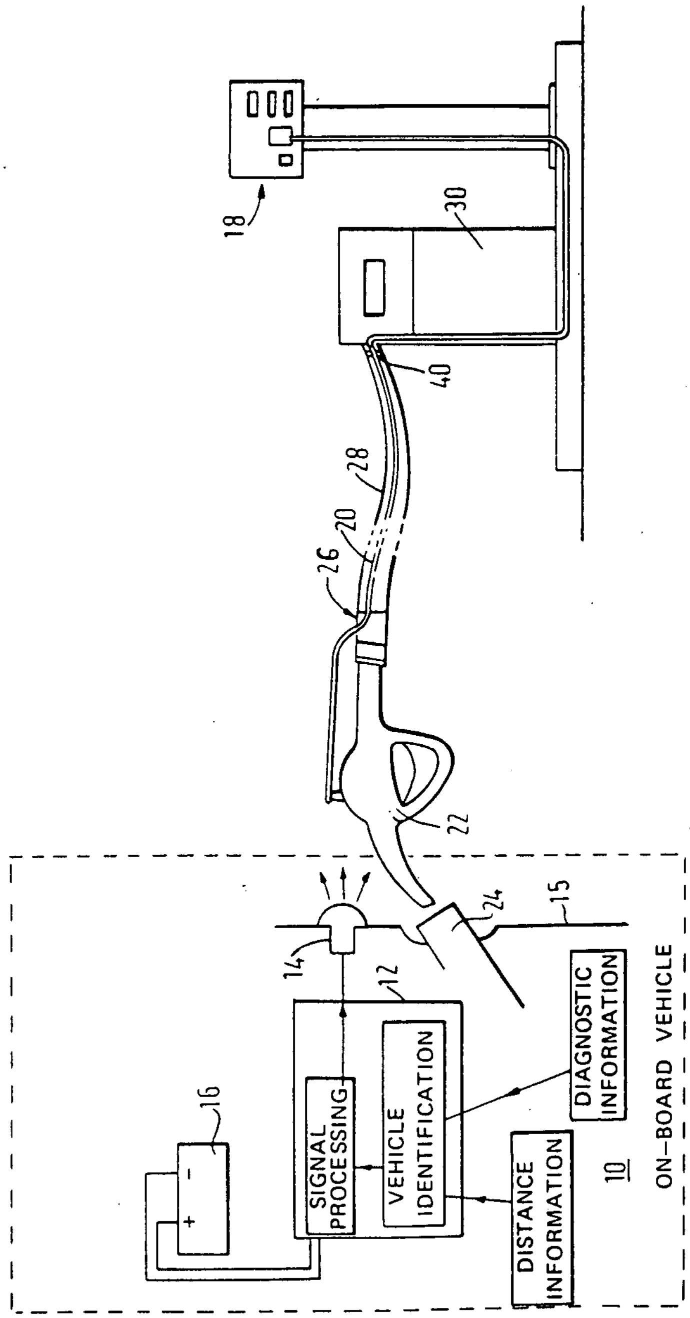
18
30
40
28
20
26
22
24
15
14
12
16
SIGNAL PROCESSING
VEHICLE IDENTIFICATION
DIAGNOSTIC INFORMATION
DISTANCE INFORMATION
10
ON-BOARD VEHICLE

FIG.1

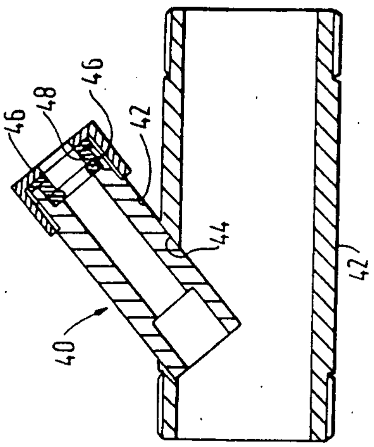

FIG.3

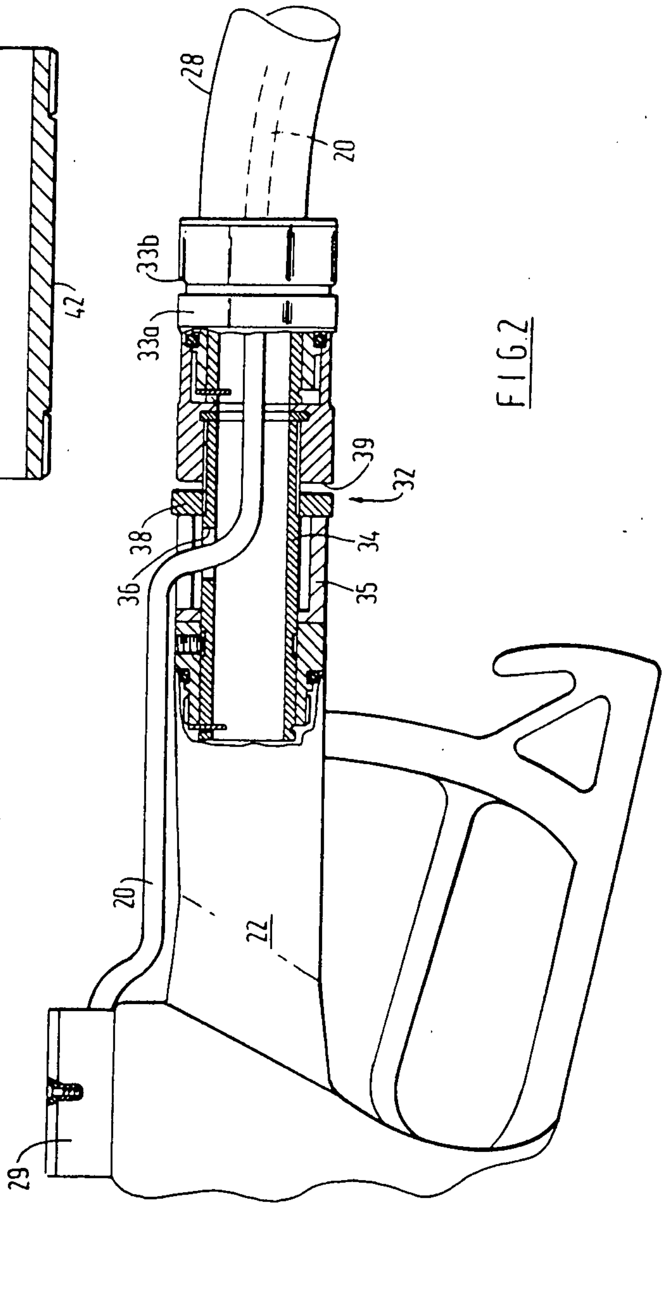

FIG.2